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PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Improvements in or relating to Photographic Light-Sensitive Elements

We, FUJI SHASHIN FILM KABUSHIKI KAISHA, a Japanese Company of No. 210, Nakanuma, Minami-Ashigara Machi, Ashigara-Kamigun, Kanagawa, Japan, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates, generally, to photographic light-sensitive elements such as photographic light-sensitive film and printing paper and, more particularly, it relates to a photographic light-sensitive material comprising a support such as a film or a paper and a gelatin layer containing a wetting agent.

In general, as a support for photographic light-sensitive elements there has been used a film of a synthetic high molecular weight material such as cellulose nitrate, triacetyl cellulose, a polycarbonate, or a polyester, a glass plate, or paper. For preparing a photographic light-sensitive element, a photographic silver halide emulsion layer is applied to the support via an undercoat. The so-called under-coat contributes to the strong adhesion of the photographic emulsion layer to the support. Also, almost all light-sensitive elements have a thin gelatin layer (a protective layer) on the photographic light-sensitive emulsion layer for preventing sticking of the surface thereof to other surfaces and preventing the formation of scratches on the surface by abrasion or pressure. Thus, photographic light-sensitive elements generally consist of many layers and it is difficult to apply uniformly the photographic light-sensitive emulsion layer and the protective layer without the use of a surface active agent which can extend the coating solution uniformly and improve the wettability thereof. The use of the surface active agent also contributes to prevent the formation of foams and comets.

When multiple layers of gelatin solutions or emulsions are applied to a support, different coating compositions are sometimes applied to a support successively as in the case of preparing photographic light-sensitive colour film. The problem concerning wetting in the case of applying a gelatin-containing composition or other colloid-containing composition to the surface of gelatin layer is completely different from the case of applying a gelatin-containing composition directly to the surface of the support. This is particularly true when the layer on which a coating composition is coated is a wet layer which has just been applied and set by cooling.

Saponin has hitherto been more widely employed as a wetting agent in the photographic industry than other surface active agents, but the addition of saponin tends to be accompanied by faults such as foaming and the quality of saponin may vary from batch to batch since it is a natural material.

Therefore, recently, synthetic materials have more frequently been used as the surface active agent in photography and various patents have been issued therefor. These patents disclose that they can be used not only for improving the wetting property of the coating composition but also as an antistatic agent and for improving the solubility of couplers, improving the permeability of processing liquids, reducing the formation of trouble by waterdrops, preventing the formation of foams in the case of applying a gelatin sol to the surface of an emulsion layer which has been set by cooling, accelerating development, and preventing contamination of the support by an anti-halation dye. All of these synthetic surface active agents

[*Price 5s. 0d.*]

are specific to these actions and, hence, some of them may provide good results on specific photographic emulsions or gelatin-containing compositions, but others are useless for improving wetting properties and preventing the formation of comets. Therefore, the use of these synthetic surface active agents is limited. Accordingly, the use of various other surface active agents for photography has been proposed.

One of the most difficult problems involved in the production of photographic light-sensitive elements is to coat uniformly colloidal silver suspended in a dilute gelatin solution. This is the case where such a suspension is directly applied to a film support to form an anti-halation layer thereon. In this case it is almost impossible to obtain a uniform suspension of colloidal silver and to apply the suspension to the surface of a support without the formation of comets.

Therefore, an object of this invention is to provide a photographic light-sensitive element having a gelatin-containing layer formed on an under-coat on a support with a good wetting property but without the accompaniment of the formation of comets, by incorporating in the coating composition for the gelatin layer a specific surface active agent.

Another object of this invention is to provide for the coating of a gelatin-containing coating composition or a photographic emulsion on an under-coat-bearing support without the accompaniment of the formations of foams and comets.

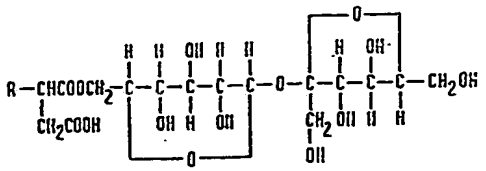
A further object of this invention is to provide for the easy coating of a second and/or third gelatin layer on a first photographic gelatin layer on a support, simultaneously or successively.

A further object of this invention is to produce an anti-static effect in the case of applying a coating composition to a film support.

A further object of this invention is to provide a coating composition which is stable and does not cause precipitation even at high temperature.

According to the present invention, we incorporate a reaction product of an alkenylsuccinic anhydride and sucrose in a coating composition containing gelatin. That is, the photographic light-sensitive element of the invention comprises a support having disposed thereon a layer containing gelatin and a mono-sucrose ester of an alkenyl succinic acid having an alkenyl group of from 8 to 18 carbon atoms.

The mono-sucrose ester of an alkenyl succinic acid used in the present invention is an ester of a long-chain acid and such ester is believed to have the following general formula:—



wherein R stands for an alkenyl group having from 8 to 18 carbon atoms.

The sucrose ester used in this invention may be prepared by the method described in, e.g., "The Journal of the American Oil Chemist Society"; Vol. 38, 417 (1961).

The amount of the surface active agent to be incorporated in the photographic coating composition is suitably 0.05—100 g., and preferably 1—50 g., per one kilogram of the gelatin in the coating composition calculated as the dry state.

By the incorporation of the above surface active agent in a photographic coating composition, the surface tension of the coating composition is reduced, the formation of foams is virtually prevented, and a very uniform coating can be obtained in normal speed coating as well as in high speed coating. Moreover, even in the case of adding a large quantity of the surface active agent to the photographic emulsion, it produces no bad effects such as yellow fog on the photographic properties of the emulsion layer as in the case of using usual polyoxyethylenic nonionic surface active agents. The surface active agent of the present invention may further be used together with other surface active agents if necessary.

The following Examples illustrate the invention.

Example 1

To 1 kg. of a photographic silver chlorobromide emulsion containing 7% by weight gelatin and 5% by weight silver halide was added 0.2 g. of sucrose monolaurate. The photographic emulsion was applied to a baryta paper, and set by cooling without drying. To the surface of the photographic emulsion layer thus formed was applied a 2.5% aqueous gelatin solution containing 1 g. of mono-sucrose dodecenylsuccinate per 1 litre of the gelatin solution, and this was dried after being set by cooling.

By this procedure, a satisfactory protective layer was formed on the photographic emulsion layer. That is, no foams were observed in the protective layer, and the coating composition for the protective layer could be applied at a higher speed than in the case where a conventional coating composition containing no sucrose ester of this invention was employed. Further, the surface of the protective layer was uniform and satisfactory.

Example 2

To a photographic silver chlorobromide

emulsion containing 7% by weight gelatin and 5% by weight silver halide was added 0.3 g. of a sodium salt of oleyl-N-methyl-tauride per 1 kg. of the photographic emulsion. The photographic emulsion thus formed was applied to a baryta paper and set by cooling without drying. On the surface of the emulsion layer thus formed was applied a 2.5% aqueous gelatin solution containing 1 g. of mono-sucrose octenylsuccinate per 1 litre of the gelatin solution, and the layer was set by cooling and dried. In this case also, very satisfactory results as in Example 1 were obtained.

EXAMPLE 3

To a photographic silver chlorobromide emulsion containing 7% by weight gelatin and 5% by weight silver halide was added a 2.5% aqueous solution of mono-sucrose dodecenylsuccinate in varying amounts in a range of 0.01—2.5 g. per 1 kg. of the photographic emulsion, as shown in the following table, and the resulting emulsion was applied to a baryta paper followed by drying. It was found that the number of comets in the emulsion layer decreased suddenly as the addition amount of the surface active agent increased, as shown in the following table.

	Amounts of surface active agent in emulsion (g./kg.).	Number of comets (per 1m² of layer).
a)	none	above 100
b)	0.01	8
c)	0.05	5
d)	0.10	1
e)	0.25	0
f)	0.50	0
g)	1.00	0
h)	2.50	0

EXAMPLE 4

To one litre of an aqueous solution containing 60 g. of gelatin and 25 g. of colloidal silver were added 1 ml. of 40% aqueous formalin as a hardening agent 2 g. of mono-sucrose octadecenylsuccinate. The dispersion was heated to 40°C. and applied to a support composed of triacetyl cellulose in a dry thickness of 20—25 microns. The surface of the layer thus formed was smooth and had no comets; it was used as an antihalation layer of a photographic element, a photographic emulsion layer being applied over the antihalation layer.

EXAMPLE 5

To a high-speed photographic X-ray emulsion containing 6% by weight gelatin and 6% by weight silver iodobromide was added 0.2 g. of a reaction product of trioxyethyl-enenonyl-phenyl ether and butane sultone. The resulting photographic emulsion was applied to a support of triacetyl cellulose and set by cooling without drying. A 2.5% aqueous gelatin solution containing 1 g. of mono-sucrose dodecenyl-succinate per 1 litre of the gelatin solution was applied to the surface of the emulsion layer thus formed and set by cooling and dried. In this case the quality of the protective layer was satisfactory; moreover, the antistatic effect of the photographic film obtained by this procedure was excellent.

EXAMPLE 6

a) To a high-speed photographic X-ray emulsion containing 9% by weight gelatin and 9% by weight silver iodobromide was added 5 ml. of an aqueous 4% saponin solution per 1 kg. of the photographic emulsion. The photographic emulsion thus prepared was applied to a support of polyester previously coated with an undercoat and, before setting the layer by cooling, an aqueous 7% gelatin solution containing 2 g. of mono-sucrose dodecenylsuccinate per 1 litre of the gelatin solution was applied to the wet surface of the emulsion layer. In this case also, the quality of the protective layer as well as the antistatic effect was excellent.

b) On the other hand, when an aqueous gelatin solution containing 5 g. of saponin, instead of 2 g. of sucrose dodecenylsuccinate, was applied to the same surface of the emulsion layer under the same conditions, the formation of comets was observed.

WHAT WE CLAIM IS:—

1. A photographic light-sensitive element comprising a support having disposed thereon a layer containing gelatin and a mono-sucrose ester of an alkenyl succinic acid, said alkenyl group containing from 8 to 18 carbon atoms.

2. A photographic light-sensitive element as claimed in claim 1, wherein said layer is a silver halide emulsion layer.

3. A photographic light-sensitive element as claimed in claim 1, wherein said layer is a protective layer on a photographic silver halide emulsion layer.

4. A photographic light-sensitive element

as claimed in any preceding claim, wherein said sucrose ester of an alkenyl succinic acid is present in said layer in an amount of 0.05—100 g. per 1 kilogram of the gelatin in the layer.

5. A photographic light-sensitive element as claimed in any preceding claim, wherein said mono-sucrose ester of an alkenyl succinic acid is mono-sucrose dodecenylsuccinate, mono-sucrose octenylsuccinate, or mono-sucrose octadecenyl-succinate.

6. A photographic light-sensitive element, substantially as hereinbefore described with reference to any of the foregoing Examples, apart from Example 3(a) or 6(b).

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